



Soil Stability Kit Introduction and Exercise

Interpreting and Measuring Indicators of
Rangeland Health

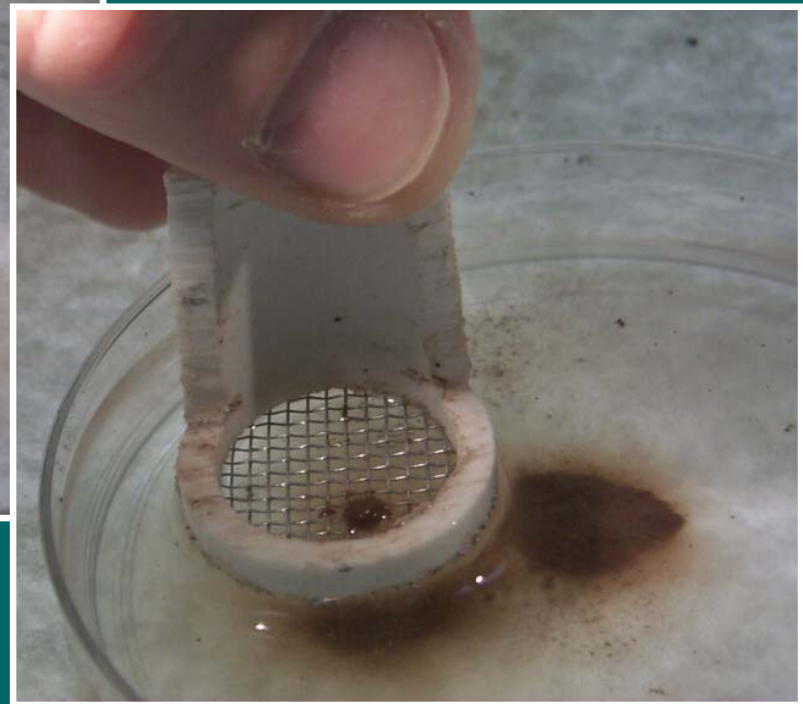
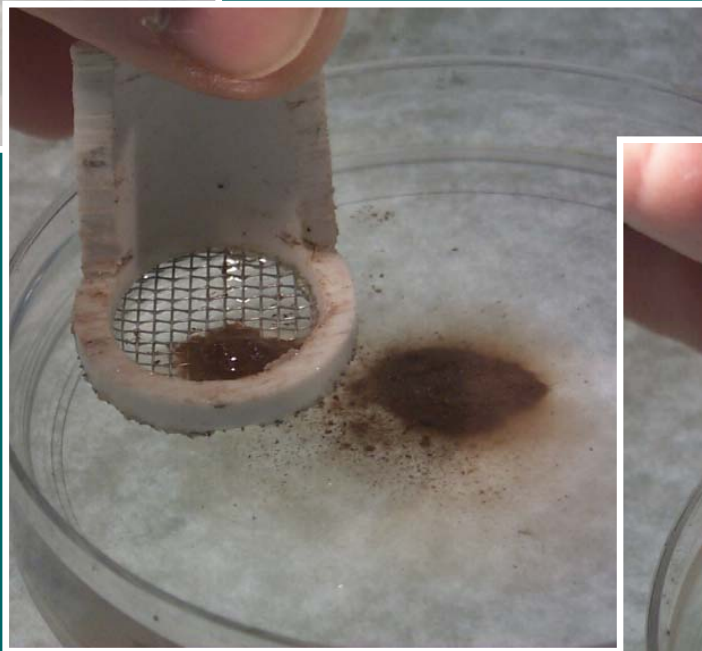
Objectives

1. Be able to consistently rate soil stability on a scale of 1-6 using the soil stability kit
2. Be able to explain the relationship between the kit values and erosion resistance for soils of different textures

*Soil Stability Kit Use and
Interpretation for Indicator 8
(Soil Surface Erosion
Resistance)*



1. Place $\frac{1}{4}$ " diameter fragment of soil on sieve in water
2. Observe: does it "melt"?
3. Wait 5 minutes
4. Lift out of water 5x
5. Rate on 1-6 scale



Outline

- ◆ Soil stability kit
 - design and use
 - interpretation
 - application: on-site inventory & monitoring
 - directly applicable to indicator #8
 - related to indicator #9
- ◆ Integration of soil measurements into inventory and monitoring programs

Why soil (surface) structure?

- ◆ Soil surface characteristics control capture and retention of water and nutrients
- ◆ Soil structure is correlated with:
 - erodibility
 - soil organic matter cycling
 - infiltration capacity & water and nutrient retention
 - recovery processes (e.g. soil biotic activity)



Why a field kit?

RELATIONSHIP TO FIELD

- ◆ Rangeland soils highly stratified, esp. surface $\frac{1}{4}$ "
- ◆ Soil structure destroyed by sampling & transport.
- ◆ Level of lab replication often insufficient to characterize site: most analyses from pits in plant interspaces

USER ACCESSIBILITY

- ◆ Relationship of results to system function can be readily explained
- ◆ Permits immediate interpretation and facilitates additional sampling when results unclear

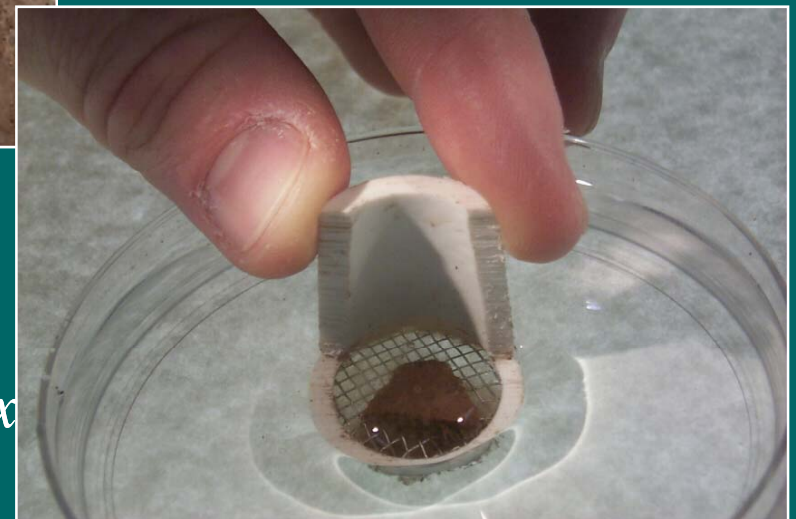
Soil stability kit: design



Materials

2 18-cell “parts” or
“tackle” boxes

18 sieves made from
1” PVC and alum.
window screen



www.countgrass.com

Synergy Resource Solutions, Inc.

5393 Hamm Rd., Belgrade, MT 59714

406.586.GRASS Office , 406.388.9359 Fax

sales@countgrass.com

Soil sampling: location is critical



Soil stability kit: use



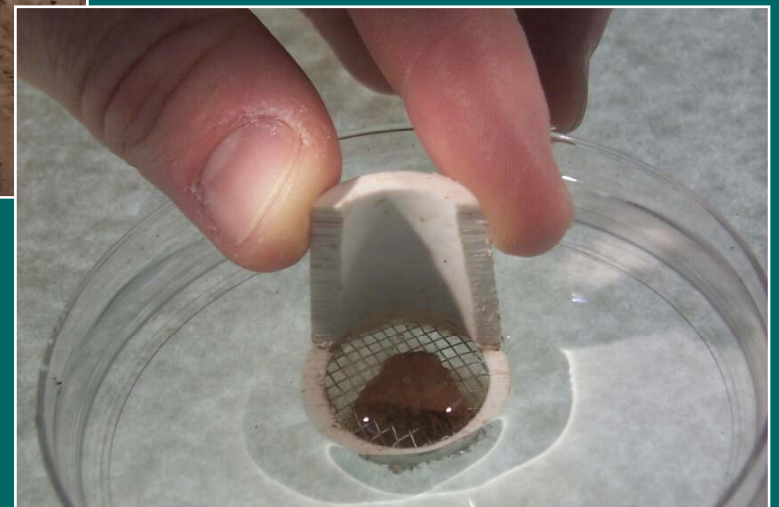
(1) Collect 6-8 mm-diameter sample from surface and 20-25mm depth (1 sample/sieve).

(2) Immerse in dl water.

(3) Record slaking in 1st 5 min.

(4) Sieve 5x.

(5) Rate sample on a scale from 1 to 6.



Stability class	Criteria for assignment to stability class (for Standard Characterization)^a
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1	50 % of structural integrity lost within 5 seconds of insertion in water.
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2	50 % of structural integrity lost 5 - 30 seconds.
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3	50 % of structural integrity lost 30 - 300 seconds after insertion OR <10% of soil remains on sieve after 5 dipping cycles.
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4	10 - 25% of soil remains after 5 dipping cycles.
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5	25 - 75% of soil remains after 5 dipping cycles.
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6	75 - 100% of soil remains after 5 dipping cycles.
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Soil stability kit: interpretation

Soil erosion: high values indicate lower **erodibility***.

Water infiltration: high values may be associated with higher infiltration rates.

Organic matter cycling: high values generally due to recently deposited organic matter produced by an active soil microbial community.



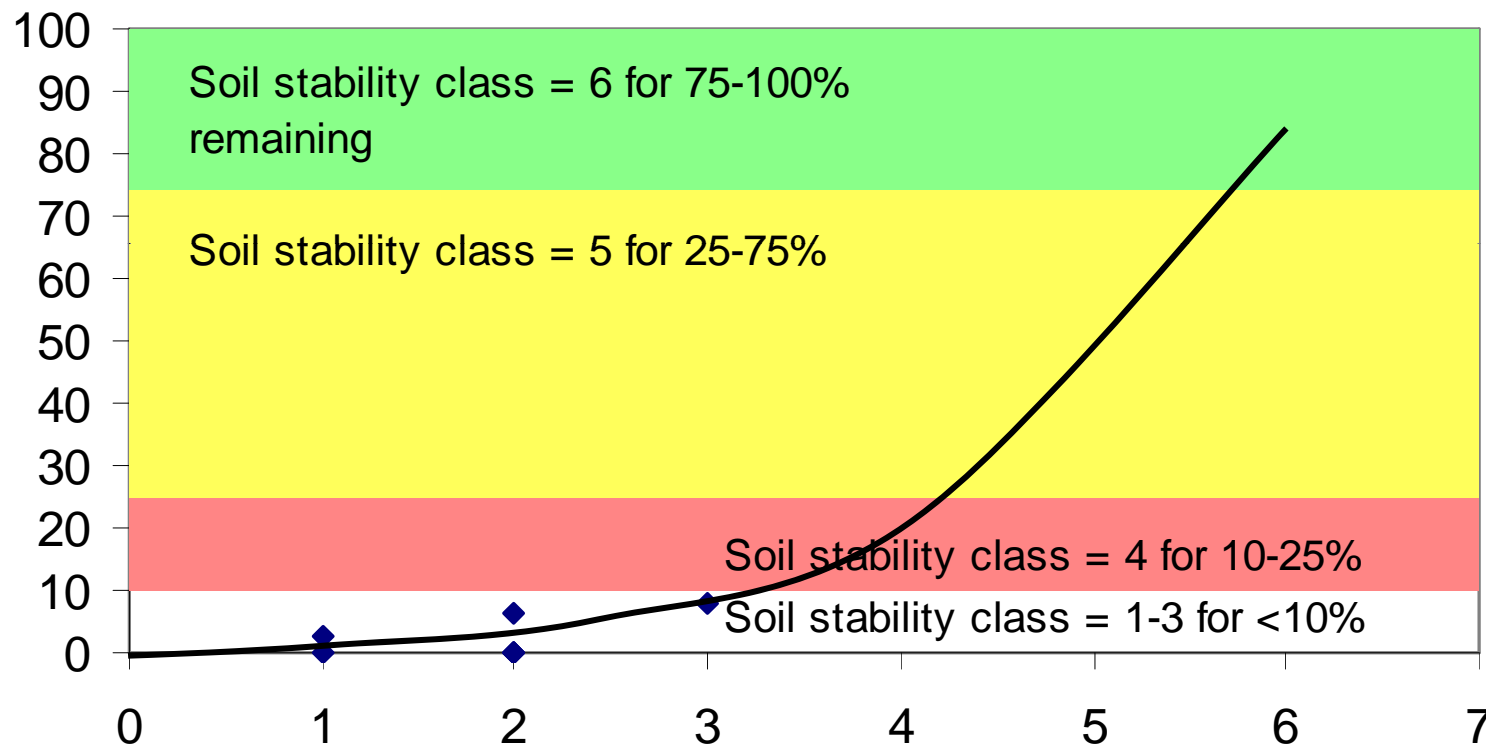
Stability class	Criteria for assignment to stability class (for Standard Characterization) ^a
0	Soil too unstable (falls through sieve) ^b .
1	50 % of structural integrity lost within 5 seconds of insertion in water.
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3	50 % of structural integrity lost 30 - 300 seconds after insertion OR <10% of soil remains on sieve after 5 dipping cycles.
4	10 - 25% of soil remains after 5 dipping cycles.
5	25 - 75% of soil remains after 5 dipping cycles.
6	75 - 100% of soil remains after 5 dipping cycles.

vs. **erosivity** which is the ability of wind, water or other factors to cause erosion

Soil stability kit: interpretation

- ✓ Quantitatively related to processes AND other measurements of these processes?
- ✓ Insensitive to single, acute disturbances?
- ✓ Sensitive to long-term changes?

Interpretation: quantitatively related to processes AND other measurements?



“... soil aggregate stability ... has been demonstrated to have a strong relationship with interrill erosion” (Blackburn & Pierson, 1994)

Interpretation: insensitive to single, acute disturbances?



<u>Strata</u>	<u>Control</u>	<u>Disturbed</u>
Control		
Bare	2.6	2.3
Grass	4.5	4.4
Bare/Grass	0.58	0.53

Post-disturbance data from gravelly-sandy loam site at the Jornada Experimental Range, New Mexico.

Interpretation: sensitive to long-term changes?

Grassland Exclosure

Grass: 25% Stability: 3.4



Grassland

Grass: 23% Stability: 2.2



Mesquite Dune

Grass: 3.9% Stability: 1.7



Summary of trampling effects

- ◆ Short-term: minimal
- ◆ Long-term: trampling reduces soil organic matter content and soil stability *unless it significantly* increases soil organic matter inputs
 - by incorporating litter and standing dead
 - by leading to a change in species composition

What about biological crusts?

- ◆ Nearly always increase stability test values
- ◆ Are nearly always more resistant to water erosion than physical crusts
- ◆ Provide approximately the same protection against wind erosion as physical crusts
Exception: coarse sandy soils
- ◆ Can increase, decrease or have no effect on infiltration

Summary: stability kit

- ◆ Soil stability test *may* be used as part of an evaluation of erosion *risk*
- ◆ In order to use as an *assessment* tool, reference values must be established for the particular ecological site.
- ◆ This test should always be used in combination with vegetation measurements, and stratified by vegetative cover
- ◆ Additional research is required to test direct relationship with erosion and other properties and processes of interest

Soil Stability Kit Exercise

Soil stability kit: use



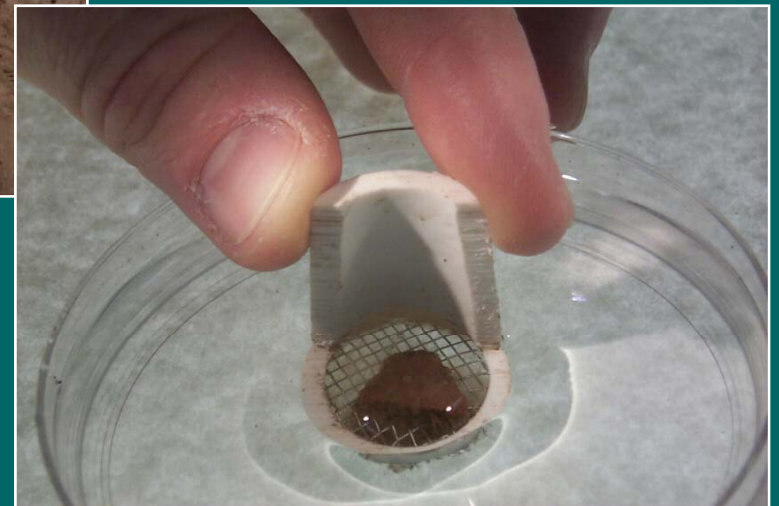
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